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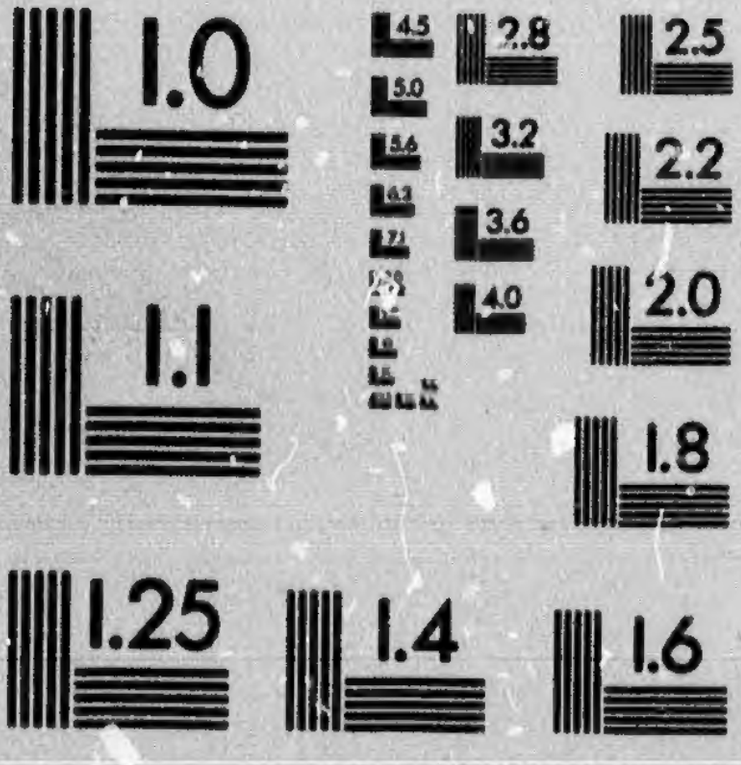

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PARTS XIII.-XIV.

Traces of the Ordovican System

ON THE

ATLANTIC COAST

AND

Organic Remains of Little River Group, No. IV.

BY

G. F. MATTHEW, D. Sc.

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XIII.—*Traces of the Ordovician System on the Atlantic Coast.*

By G. F. MATTHEW, D.Sc.

(Read May 25, 1893.)

In the early history of the geology of the maritime provinces of Canada the distinction between the different grand divisions of the Palæozoic rocks was not very clearly drawn.

This arose partly from the fact that the earlier geologists drew no distinction between the Cambrian and Lower Silurian (Ordovician) or between this and the Upper Silurian; and partly because all the Palæozoic deposits, except the Carboniferous, had been greatly disturbed and folded in almost every part of this region. Owing to these disturbances there exists here a confused complex of the older and middle Palæozoic that is difficult to unravel.

But the want of sharpness and accuracy in the several divisions of the Palæozoic rocks has also arisen from the scarceness of well preserved fossils, whereby these divisions and their several parts could be distinguished from each other.

Latterly, and by slow degrees, group after group of the older Palæozoic rocks have been recognized, and the earlier classification improved. First, Dr. Abraham Gesner distinguished the Silurian (Upper) of the northern part of New Brunswick; then Sir J. W. Dawson claimed the existence of Silurian (Upper) and Devonian in the valleys of Cornwallis and Annapolis in Nova Scotia; at a later date Dr. D. Honeyman collected the Silurian (Upper) fossils of Arisaig, N.S., which were described by Jas. Hall, and the Cambrian fossils of Mira River, C.B., recognized as such by J. W. Salter. At a later date the officers of the Geological Survey discovered Silurian fossils at Winthrop Station, N.S.

Meanwhile the Cambrian rocks of St. John were determined as such by the discovery of a distinctive marine fauna; and the Devonian age of plant-remains of Lancaster was asserted by Sir Wm. Dawson. Subsequently the officers of the Geological Survey distinguished by their fossils the rocks of various Silurian (Upper) areas in New Brunswick.

But among all these no trace of an Ordovician fauna had been obtained. The first step in this direction was the discovery (1880) of fossils of this age in certain quartzites and siliceous slates on the Becaguimic River in the northwestern part of New Brunswick. These were a species of *Harpes*, a *Leptobolus*, another Brachiopod resembling *Leptella* (?) *decipiens*, Bill.,[1] and other fossils, undetermined. To the southwest of

[1] Rep. Prog. Geol. Surv. Can., 1885, Rep. G, p. 25.

this locality, on the line of strike of these slates, in the state of Maine, graptolites of the age of the Llandeilo rocks were subsequently found, showing the extension of a band of Ordovician slates southwest into the state of Maine. Subsequently the same band was traced eastward through New Brunswick to the Baie Chaleur. Thus was established the existence of a belt of Ordovician rocks crossing northern Maine and New Brunswick, southward of the belt of Silurian (Upper) rocks discovered by Gesner.

Ordovician strata were next discovered in southern New Brunswick at St. John, where there are beds with Arenig graptolites infolded with the Cambrian rocks of that place. As these beds with graptolites are an integral portion of the upper division of the St. John Cambrian terrain, it is evident that there is here a second belt of Ordovician rocks in New Brunswick.

But though we have been able to recognize two bands of these rocks in the province above named, no Ordovician strata have yet been determined in Nova Scotia. It is true that Dr. Honeyman had claimed that the fossils of Wentworth Station were Lower Silurian, but this view was contested by Mr. Billings, who could find here nothing older than the Clinton Group.

On examining the fossils sent me by Mr. Howley from Newfoundland, and referring to notes made some years ago on others collected in Cape Breton by the officers of the Geological Survey of Canada, it became evident to me that still another belt of these rocks existed along the Atlantic coast. This belt has remained unrecognized owing to the scarcity, and, in many cases, the bad condition of the fossils.

The fossils more recent than the Cambrian in southeast Newfoundland, are those of Great Bell and Kelly's Islands in Conception Bay. Mr. Billings described some of these many years ago, but he left undetermined the genera of his species which I describe below. Under modern methods of determining genera, it becomes necessary to know something of the interiors of the Brachiopods, and as these are not described nor figured by Billings for the species in question, I sought from Mr. Howley an opportunity to examine those in the museum at St. John's, and from Mr. Whiteaves, those at Ottawa.

The declared age of the rocks containing these fossils has been governed by that of the adjoining and very characteristic Cambrian faunas (in Newfoundland, Lower Cambrian, in Cape Breton, Upper) and so the indications of these rare and obscure genera of Palæozoic type later than the Cambrian, has been overlooked. In Newfoundland, the Ordovician or Silurian rocks are, in Kelly's Island, gray micaceous sandstones, and in Great Bell Island, pale gray, white-weathering, coarser sandstones, dipping at a low angle; while the Cambrian rocks of the mainland adjoining are shales with limestone beds and dip at a higher angle.

In the Island of Cape Breton the rocks of the shore of Bras d'Or Lake, near Barrosois Brook, consist of various alternations of sandstones, slates and shales.[1] Some of the shales, away from the shore, on the Barrosois or McLeod Brook, contain *Dictyonema flabelliforme*, and are therefore Upper Cambrian. The coarser beds on the shore of Bras d'Or Lake which contain the fossils described below are more modern, as will appear by the following review of their fossil contents.

In the following description the fossils are arranged according to their zoological standing.

LINGULIDÆ.

LINGULELLA, Salter.

In the collections examined there are two species that may be referred to the above genus, although the impressions of the sliding muscles are more external than Mr. Salter has declared to be the case in the Welsh species, *L. Davisii*, the type of the genus. The Canadian species were collected in Cape Breton and occur in a calcareous sandstone which has suffered from dynamical movements, and the fossils are all considerably distorted: the figures of the species are adjusted for this distortion.

LINGULELLA SELWYNI, n. sp., Pl. I., Figs. 1*a* and *b*.

The form is sub-ovate, broadly rounded in front, but having nearly straight sides in the posterior half; the beak of the ventral valve is regularly pointed and that of the dorsal bluntly rounded.

The ventral valve in its interior, exhibits two large, triangular scars, where the central muscles were attached, one on each side of the rhombic pit in the posterior third of the valve. The posterior adductors appear on each side of the hinge area, and there are sliding muscles exterior to and in front of them. In front of the posterior adductor muscle, on each side of the valve, there is a low ridge extending forward as far as the scars of the central muscles: at and in front of these ridges the imprint of the main vascular trunks is visible, extending forward toward the median line.

The interior of the dorsal valve has a broad scar (posterior adductor ?) just in front of the striated hinge area, and on each side of the hinge are impressions of sliding muscles. The central muscles are indicated by a group of small pits near the centre of the valve; of these the anterior adductors are oval and somewhat apart at the mid-length of the valve; the anterior adjustors are indicated by a pair of small rounder pits, a little in advance of those last named and closer together. A faint line (indicating the border of the splanchnocœle ?) includes these scars and

[1] Geol. Surv. Can. Rep. Prog., 1875-6 (Fletcher's Report), p. 389.

runs back toward the posterior part of the valve. Extending forward from near the cardinal area on each side are the lateral ridges and the imprint of the vascular trunks, as in the ventral valve, but here more distinct and bearing a number of branches directed, some inward and some outward.

Sculpture.—The external surface of the valve of this species is marked by fine concentric lines, and fainter radiating lines; there ar also at intervals, concentric growth lines, and less distinct undulations of the shell, radiating from the umbo.

Size.—Dorsal valve. Length and breadth, each about 11 mm. The ventral valve is about 1·5 mm. longer.

Locality.—McFee's Point, George River, Cape Breton, collected by Messrs. Weston and Robert, of the Canadian Geological Survey.

The plan of the muscular scars of this species is very nearly that of *Obolus Quenstedti* of A. Michwitz, found in Esthonia, Russia,[1] and as we find a shell in the Lower Cambrian of the St. John Group which possesses all the essential characters of an Obolus, but differs from this shell, we fully agree with Messrs. Hall and Clarke, that *O. Quenstedti* could, with propriety, be excluded from Obolus; whether it should go into Lingulella will be better known when the internal features of the species *L. Davisii*, the type of that genus are more fully described.

LINGULELLA ROBERTI, n. sp., Pl. I., Figs. 2*a* and *b*.

Broadly ovate, the ventral valve acuminate, having a low mesian ridge in the posterior third, and slightly upturned at the beak. The dorsal valve tumid posteriorly, with a narrow hinge-margin, the valve has a mesian grove in the posterior quarter, and is flattened toward the front.

In the ventral valve the inner surface of the thickened posterior part of the valve carries two pairs of diverging ridges, the inner pair terminating at the scars of the anterior adductors, the outer pair of about equal length, but continuous with impressions of the curving vascular trunks.

The dorsal valve also has in its interior four diverging ridges; within the two outer ones at the back of the shell is the impression of the posterior adductor muscle; and within the two inner ones, one-third from their ends, are the oval pits of the anterior adductors; between these scars, and extending backward in the valve, is a faintly marked mesian ridge, placed about one-third from the posterior end of the valve. The pits of the anterior adductors diverge somewhat at their anterior ends, and a short distance in front of them are two small, round pits, near together, which mark the points of attachment of the anterior adjustors.

Sculpture.—This consists of irregular concentric striæ which inosculate with one another, producing a surface of broken ridgelets, similar to

[1] Genera of Palæozoic Brachiopods, Hall and Clarke, p. 337, figs. 38 and 39.

that of an Acrothele; the concentric ridges are of unequal size, and there are occasional more distinctly marked growth-lines.

Size.—Length of the dorsal valve, 13 mm.; width about the same; the ventral valve is about 1·5 mm. longer.

Locality.—Same as the preceding. Found in a sandy limestone by Messrs. Weston and Robert.

This species is very little larger than the preceding, but is distinguished by its radular ornamentation and thicker valves; also by its acuminate upturned beak, its tumid dorsal valve, and by the position of the central muscular scars of this valve; these scars are in the posterior half of the valve, but in *L. Selwyni* about the middle of the valve.

Mr. J. F. Whiteaves has very kindly loaned me for comparison with the Lingulellas of the Ordovician of the Atlantic coast, examples of a Lingulcid shell from Beverly, Ontario. Some of these shells show the interior surface of the valve, and are described and figured to show the distinctness between the genera Lingulella and Lingulepis in the position of the muscular imprints, etc.

LINGULEPIS, Hall.

LINGULEPIS ACUMINATA, Conrad, Pl. II., figs. 5*a* and *b*.

Lingula acuminata was originally described by T. A. Conrad from specimens found in boulders from the calciferous sand rock [1] of the State of New York. The specimens, however, are very much smaller than the Canadian shell I am about to describe, and differ considerably in form; still Mr. Walcott appears to recognize Conrad's species as identical with the species from the Upper Cambrian near Saratoga, described by him, some examples of which are represented as attaining the size of the Canadian form; and further he compares the Saratoga form with *L. pinnæformis*, which evidently is congeneric with the Canadian form. The western species, however, is more prolonged at the beak than the examples of *L. attenuata* figured by Dr. Hall, or than those of the Canadian form.

It is chiefly the internal characters of the Canadian shell that will be described:

The ventral valve appears to have no area, but finishes with a rim similar to that of other parts of the shell. Near the umbo there is a narrow extension of the visceral callus upon which is a small scar of the cardinal muscle. Extending forward on each side of the narrow part of the callus are bands along which the lateral muscles travelled during the

[1] Palæontology of New York, vol. i., p. 9, fig. at bottom of the page.

growth of the shell: they are three in number, and perhaps are only the outer laterals, for on the inner band (transmedians?) no scars have been detected.

The central muscles (anterior adductors, etc.) rest on a quadrangular shield, considerably in advance of the laterals: each set is included in a somewhat pear-shaped area, which has an elliptical scar in front, and a deep, narrow scar on the inner side. The front of the visceral cavity probably is indicated by an isolated scar half way between the central scars and the anterior margin. The vascular trunks on this valve have not been observed.

The dorsal valve is obovate and has broad, flat, lateral margins, that were partly external to the edges of the ventral valve.[1] A visceral callus of the shell at a young stage shows lobed divisions, produced by the advance of the central and lateral muscles as in *Lingulepis pinnæformis*: outside of these we see the lines of progression of the same muscles over a shell surface from which the visceral callus has been exfoliated; on this surface are exhibited the imprints of the central (anterior adductor) and interior lateral (transmedian?) muscles: the position of the anterior adjustors is indicated at the point of the impression of the visceral callus in front of the centrals. The vascular trunks sweep forward from the sides of the shell, with a slight curve toward the front, and are separated by a space marked with vascular lines; no branches were observed.

The anterior parts of both valves are abundantly marked by the fimbriated edges of the mantle margin.

Sculpture.—Externally the valves of this species appear to be smooth, except for the numerous concentric raised lines of growth; these are particularly numerous on the convex posterior portion of the ventral valve. A lens of half-inch focus exhibits a minutely cancellated surface on the lateral slopes of the valves.

Size.—Length of ventral valve, 18 mm.; width, 14 mm. The dorsal is 2 or 2½ mm. shorter.

Horizon and *Locality.*—Pale brown sandstone from Beverly, Ont.

This species exhibits affinities to Lingula rather than Lingulella; as witness the absence of an area on the ventral valve, and the transverse position of the anterior adductor muscles of the dorsal valve. Among species whose interiors have been figured, that of *Lingulepis pinnæformis*, Hall, closely resembles that of the Beverly form.

The course of the vascular trunks and the attitude of the muscular scars of the central group easily distinguish this genus from Lingulella.

[1] The features of this valve are described from several different specimens, no single valve having been found in which all were visible.

LINGULA, Bruguiere.

LINGULA HOWLEYI, n. sp., Pl. I., Figs. 3*a* and *b*.

Among the fossils sent me by Mr. Howley was a large Lingula of peculiar shape.

General form quadrate, with obtuse cardinal slopes, apical angle about 105°. Sides nearly parallel, spreading slightly toward the front, anterior angles obtusely rounded, and having the front, for half its length, straight. The surface of the valves for nearly one-quarter of their width, on each side, is flattened—concave.

The ventral valve has a broad rounded ridge along the middle, which descends at four-fifths from the front of the valve, somewhat abruptly, to the front edge; the lateral thirds are concave, especially toward the beak, and the posterior edges of the valve are bent down or involute; apex bluntly rounded.

Some features of the interior appear on the abraded surface of the valve examined. Two widely diverging ridges spread from the umbo toward the lateral edges, their ends being more than half way to the front of the valve, and about one-eighth of the width of the valve from its edge. About midway of the valve a rhombic area is outlined, at the front of which, on each side, would be the place of the anterior adductor muscles.

The dorsal valve has the same outline as the ventral, but the edges of its posterior slopes are revolute, forming a channel on the outside of the shell at its back. The raised central part of the valve is wider in front than that part of the ventral valve.

An abraded example of this valve shows imperfect traces of the pits of the posterior adductor and of the lateral muscles, and an imperfect outline of the visceral cavity.

Sculpture.—Only small fragments of the outer surface of the shell have been preserved; these show that the surface was ornamented with numerous concentric, rounded ridges; and under a strong lens the surface appears to be minutely granular.

Size.—Length, 35 mm.; width, 22 mm.

Locality.—Micaceous gray sandstones of Kelly's Island, Conception Bay, Newfoundland, in company with *Lingula Billingsiana*, Whiteaves.

This shell changed its form considerably during growth. When it attained the size of 8×11 mm. it was of a regular oval form, like *L. Quebecensis* and several others of its genus, but then began to grow quadrate. When three-quarters of its full length it was more rectangular than *L. quadrata*, and continued to grow more quadrate until it reached maturity.

We know of no Cambrian Lingula to which this Newfoundland

species can be compared or referred; its great size is unparallelled among the species of that age, and only as early as the Ordovician time do we find similar large Lingulæ; none of these, however, agree with *L. Howleyi* in form. The well known *L. quadrata* is much less rectangular, and its cardinal slopes are more acute. *L. quadrata* is found in the middle and upper part of the Trenton, and in the Baltic provinces of Russia appears (by de Verneuil's localities) to occur in beds equivalent to the Llandeilo Group of Britain. *L. Canadensis* of the Hudson R. beds in Anticosti is another large quadrate species, but it is a third wider, and has a cancellated surface. *L. Nympha* of the Chazy beds of northern Newfoundland is one of the oldest of these large Lingulæ; but it is longer and narrower than our species. *L. Quebecensis*, another large species of the Quebec group (Arenig horizon), is regularly oval. A species which in its general form appears to be nearer our species than any other is *L. Lewisii*, Sow.[1] This is said to be somewhat smaller than the Newfoundland species, but it has similar obtuse beaks and parallel sides. Following the biological indications given by *L. Howleyi*, the sandstone in which it is found cannot be older than the Ordovician time. But it is probably even younger, for there is no species that more closely resembles the Kelly's Island Lingula than *L. Lewisii*, Sow. Sowerby's species is found in the middle and upper part of the Silurian (Upper) in the west of England. This resembling species from Newfoundland shows even more strongly the variation to a quadrate form, and is perhaps fully as modern as the English shell.

This species is named in honour of J. P. Howley, director of the Geological Survey of Newfoundland.

TRIMERELLIDÆ.

Among the Brachiopods received from Mr. Howley were some large thick shelled species, examples of some of those which had been described by E. Billings, and which this author had provisionally, but doubtfully, referred to Lingulella.[2] They are larger and thicker than the known species of Lingulella, and their deep muscle-scars, incipient partitions in the umbo and other characters appear to ally them to the Trimerellidæ; but it does not seem possible to refer them to any described genus.

LINGULOBOLUS, n. gen.

A rather large inarticulate brachiopod, valves thickened around the visceral cavity; the thickened portion consisting of successive plates, but there is no true vaulted platform. The borders of the thickened part of

[1] I am indebted to Mr. G. Van Ingen, of Columbia College, N. Y., for copies of Mr. Davison's figures of this species.

[2] Palæozoic Fossils, vol. ii., pt. i., p. 67, figs. 35 and 36*a-c*.

the shell, or [illegible]io-platform are raised, and there is a median plate or septum. A band similar to a crescent goes around the back of the shell within the deltidial area, and connects a set of three lateral muscles. The arrangement of the muscle-scars, especially the centrals, is like that of Lingulella, of the laterals like Trimerella and the parietal bands have the position of those of Lingula. The notation used in describing the parts of this and of the following species, is that of Davidson and King for the Trimerellidæ. The type of the genus is *Lingulella* (?) *affinis*, Billings.

LINGULOBOLUS AFFINIS, Bill., sp., Pl. I., Figs. 4*a* and *b*.

Lingulella (?) affinis, Billings, Palæoz. Fossils, vol. ii., pt. i., p. 67, fig. 35.

Mr. Billings's description of this species is as follows:

"Ventral valve elongate, conical, or acutely triangular. Apical angle 45°. Front margin gently convex in the middle, rounded at the angles; sides nearly straight, uniformly converging from the anterior angles to the back. Surface of very fine, longitudinal striæ, about ten in the width of a line. This species is founded on the single specimen of a ventral valve above figured. The upper two-thirds is partly worn away in the middle, leaving only the outline in the stone. It appears to have been, when perfect, gently convex, the rostral portion near the beak, semi-cylindrical. Length about thirteen lines, width nine lines. The dorsal valve has not been identified."

Among the specimens from Great Bell Island received from Mr. Howley are some examples of a large shell which, though it differs in its proportions from Billings's figure of *L. ? affinis*, I believe to be this species, for while he speaks of the apical angle as being 45°, it is actually as drawn, 55°. The type specimen is perhaps narrowed by pressure. The internal markings of the shell sent me by Mr. Howley are so well shown, that whether this shell is or is not *L. ? affinis*, it is worthy of description. These internal markings are as follows:

In the dorsal valve the cardinal muscle is divided, and is close to the margin; in front of this muscle on each side are the oval scars of a large pair of lateral muscles; these scars have a pointed anterior lobe, and extend forward to a point one-third of the length of the shell from the hinge-line; in front of these scars is a faint, oval incurved impression (muscle scars ?) extending half way to the front of the valve; these form on each side of the valve the anterior end of the crescent. The central muscles form a group of scars just behind the middle of the valve; there are two large laterals and a group of small central muscles about as distant from the laterals as these are from each other: the small central group is resolvable into four little scars; the two posterior contiguous and parallel; the two anterior approximate, but spreading anteriorly. A

pair of minute (sub-cardinal ?) muscle scars lie about half way between the cardinal muscles and the large laterals of the central group.

A pair of vascular trunks extend from inside the lateral scars, forward for some distance beyond the central scars, angling inward : from the inside of these trunks, about six branches extend toward the centre of the valve, and finer branches radiate from their outer edges. The edges of the valve and the growth ridges of its outer surface are marked by numerous crenulations or furrows directed outward.

The ventral valve is more elongated than the dorsal, and in some examples has a wide, faint depression along the centre of the deltidial area. A triangular area on each side of the valve extending two-fifths from the apex marks the position of the lateral muscles ; at the back of the triangle is the scar of the umbo-lateral, and at the outer corner is a group of three small oval scars, constituting the main lateral group of the crescent. The rhombic pit marking the position of the central group of muscles has a crenulated band along its centre due to the central muscles, and on each side are the prints of the laterals.

The crenulations of the margin of the shell, where the vascular lines terminate (marked on the outside of the shell by radiating striæ) are about as far apart as the striæ on the outer surface spoken of by Mr. Billings. There is a slender median ridge to the valve, and on each side of this a calcareous thickening of the valves marking the edges of the pseudo-platform. The crescent in this species is of the nature of a parietal band as it incloses the muscles and does not form a broad band in which the muscle-scars are inclosed as represented in the figures of Messrs. Davidson and King for Trimerella.

Var. CUNEATA, Pl. I., Figs. 4*c* and *d*.

Among the examples in the Museum at Ottawa is an example of a ventral valve which shows considerable difference in the form and the markings of the interior. It is a deeper shell, with more abrupt lateral slopes and is more triangular in outline at the front. It is a mould from which the shell has been mostly exfoliated. There is no trace of a deltidial groove or depression ; the main muscle-scar of the crescent is undivided, and the anterior muscle-scar of this group distinctly visible is small : the sides of the pseudo-platform arch outward, the large, central muscles have left double scars, and the median septum is more decidedly shown than in the typical form. A distinct parietal band has a position similar to that in Lingula. The example studied is a quarter shorter than full grown examples of the typical form.

We cannot discover that there is any hollow platform in this species as there is in Trimerella, the central thickened part of the shell of the ventral valve corresponding to the platform in the ventral of that genus ;

there is an incipient calcification and thickening of the edges and a median ridge.

Sculpture.—The surface ornamentation of longitudinal striæ is as described by Billings, but transverse growth lines also are present, and give the surface of the shell a cancellated appearance.

Size.—In the specimens sent from Newfoundland the length is as given by Mr. Billings, but the width is greater. Length of the ventral valve 27 mm., width 25 mm. The dorsal valve is about 3 mm. shorter. An example of the ventral valve in the museum at Ottawa has a length of 30 mm. and a width of 28. Depth approximately 3 mm.[1] These dimensions exceed those of any Lingulella known to me, but are such as would be looked for in shells of the Trimerellidæ.

Locality.—The gray white weathering sandstones of Great Bell Island, Conception Bay, Newfoundland.

The genus Trimerella to which this one is allied, is found in the Silurian (Upper) in Ontario, Sweden, etc.

SPHÆROBOLUS, n. gen. (provisional.)

This orbicular species is so different from the preceding (if Mr. Billings and the author have correctly interpreted the valves described as the ventral and dorsal valves respectively of this species) that it must be placed in a different genus. The unusual distinctness of the vascular trunks and their branches in the supposed ventral valve, the advanced position of the central group of muscles in this valve, and the rarity of this valve in the material examined, also allow some doubt to remain as to whether this valve is a ventral. But it is evidently the valve which Mr. Billings regarded as the ventral of this species. Regarded in this light the genus finds its nearest relative in Dinobolus of Dr. Hall, which has valves of similar form; the resemblance to the Newfoundland species can be traced in the crescent and its scars and in the platform and its inequalities.

The thickened umbo of this form, especially in the dorsal valve, appears to have had spaces between the layers (now filled by a powdery siliceous deposit) that compare with the cavities in the umbones of Trimerella and other brachiopods; but we do not observe any vault or excavation beneath the thickened visceral part of the valves. The type of the genus is *Lingulella* (?) *spissa*, Bill.

SPHÆROBOLUS SPISSUS, Pl. I., Figs. 5*a–c*.

Lingulella ? spissa, Billings, Palæoz. Fossils, vol. ii., pt. i., p. 66, figs. 36*a* to *c*.

Mr. Billings's description of this species is as follows:

"Shell subpentagonal or subovate, length and width about equal, sometimes strongly ventricose. Dorsal valve with the front margin

[1] Measurements by Dr. Ami of the Geological Survey.

straight, or very gently convex, for about two-thirds of the width in the middle; anterior angles rounded; sides straight or slightly convex and subparallel until within two-thirds, or one-fourth the length from the back, then converging to the apex, where they form an obtuse angle which varies from 100 to 110 degrees. This valve is generally very convex, sometimes almost hemispherical; the outline on a side view is rather abruptly elevated in the rostral third, depressed convex for a short space in the middle and then more gently descending to the front margin. Most of the specimens of this valve are eight or nine lines in length and about the same in width.

"The shell which is supposed to be the ventral valve of this species is gently convex, with usually a somewhat flattened space extending from the front margin upward toward the beak. The apical angle appears to be from 90 to 100 degrees. Shell very thick, of a lamellar structure, dark brown or nearly black, and sometimes when exfoliated, of an ashy gray colour. Surface with a number of obscure undulations of growth, and with fine longitudinal striæ about ten in the width of one line."

In the examples which the writer has seen the following features were observed:

The mould of the interior of the dorsal valve shows heavy muscle-scars. At each end of the hinge line is a small umbo-lateral scar; from these scars a crescentic ridge extends forward on each side of the valve about two-thirds of its length, and terminates at a small scar; within the bow of the crescent and about midway of its length is a large oval scar. The central scars as a group are in front of the midlength of the valve; of these the lateral scars are equidistant from the beak and front of the valve; the central scar is faintly double and is nearly three-quarters the length of the shell from the hinge; behind it is an oval scar, elongated, and having a septum or thin plate on the median line of the valve.

Vascular trunks extend forward on each side of the valve, from the middle almost to the front margin; from these trunks about half a dozen branches turn inward toward the visceral cavity, and more numerous branches outward toward the margin of the valve.

The ventral valve also has strong muscle-scars. There is no pedicle-groove, but a small rhombic ridge extending into the deltidial area may indicate a pedicle-pit; behind this on each side are small scars (of the cardinal muscle?)

The lateral muscles of this valve are more approximate than those of the dorsal, and the crescent is not so distinct; the umbo-lateral scar is near the margin and is separated from the other two laterals which form a sigmoid curve and are in contact at their ends. In the central group of muscles the large paired scars are smaller, and in some examples closer together than those of the dorsal valve, and between them lies a median

ridge, divided lengthwise by a narrow septum, which extends from the middle of the valve half way to the front.

The imprint of the vascular trunks in this valve begin about one-third from the back and extend well forward on each side toward the front margin; there are about five branches turning inward toward the visceral cavity and numerous branches turned outward.

As indicated by Billings's name the valves of this shell are thick; they consist of four to six layers which are separated by a pulverulent substance; the spaces are perhaps cavities filled by infiltration subsequent to the entombment of the shells; the thickening of the shell is mostly posterior to the central muscles, though the margins of the pseudo-platform outside of these muscles are thickened.

The shell, by its massiveness and the arrangement of the muscle-scars, shows affinities with the Trimerellidæ, though we cannot refer it to any particular genus of that family. Its general form is that of Dinobolus and of the Dinoboli figured by Messrs. Hall and Clarke, it appears to be nearest to *D. Conradi*,[1] but it differs from all these by the oval form of the main scars of the central group, which are thus more like the central scars of Lingulella, so far as in that genus the dorsal valve is concerned.

The orbicular form, narrow mantle margins and heavy lateral muscles, give this shell a superficial resemblance to the Obolidæ, but the arrangement of the muscles, especially those of the ventral valve, is quite different.

Sculpture.—There is nothing to be added to Mr. Billings's description of the external features or surface markings of this shell.

Size.—Length of the dorsal valve 32 mm. Width 33 mm. The ventral valve is about 2 mm. longer than the dorsal.

Locality.—Great Bell Island in Conception Bay, Newfoundland, with the preceding.

This species is distinguished from the preceding by the advanced position of the muscle-scars and by having much narrower mantle margins, as well as by its general form.

The genus Dinobolus, to which this is allied, is found both in the Ordovician and Silurian systems. *Dinobolus Conradi* belongs to the Niagara group.

In endeavouring to determine the geological horizon of the sandstones in the islands of Conception Bay one is left in uncertainty by the few species found there and the small collections of fossils obtained from those islands. The fossils were formerly referred to the Potsdam sandstone, as they were thought to have a Primordeal aspect. But Cruziana and Eophyton, which occur there, are tracks or trails of animals, and the

[1] Op. cit. Pl. iv. B., figs. 13 to 24.

species that made them are not known. The large forms of Eophyton (*E. Jukesi ?*), those having bands of long, straight or arched and parellel striæ, which the writer has referred to Ctenichnites, have been found at several horizons ranging from the lowest Cambrian to the Silurian (Upper) and so give but little help. The remains of animals actually found, Linguliдæ and Trimerellidæ, appear to have their best known analogues in the Silurian (Upper) and are at least as late as the Ordovician age.

ORTHIDÆ.

CLITAMBONITES, Pander.

CLITAMBONITES (GONAMBONITES) PLANA, Pander, var., Pl. II., Figs. 1*a* to 1*c*.

Gonambonites plana, Pander, Beitr. zur geogn. Russl. p. 78, pl. 16.
Orthis plana, deVerneuil, Russ. and Ural M't'ns, vol. ii., p. 199, pl. xi., fig. 7*a-h*.
Clitambonites plana, Hall and Clarke, Gen. Palæoz. Brachiop. pl. vii., fig. 28.

The following is de Verneuil's description of this species: "Shell semi-elliptical, depressed, with sharp edges, horizontal, not sinuous, and having its greatest width at the cardinal border. Ventral [dorsal] valve but little convex, provided with a very feebly marked sinus, and an area inclined almost 60° on the plane of the lateral edges. This area is two or three times less elevated than the area of the dorsal [ventral] valve, has in the middle a triangular slit, closed by a convex deltidium, which meets the deltidium of the opposite valve, and intercepts all apparent communication from the interior to the exterior. Under the deltidium in the form of a lip is found as in the preceding species [*Orthis inflexa*] a median tooth and two small lateral teeth. The dorsal [ventral] valve is flat and having depth only toward the area; this, high and a little recurved, is inclined like the area of the opposite valve, about 60° from the plane of the lateral edges; its surface is smooth and shows no vertical striæ. The triangular slit is narrow, and its angle at the summit from 30° to 40°. The surface of the two valves is covered with radiating striæ, fine, equal, several times dichotomous in their length, and not increasing in their size from the beak to the borders: at 10 millimetres from the beak one may count about 12 in the the space of 5 mm; they appear a little crenulated, and are interrupted by three or four transverse rings raised in steps.

"In the interior one observes under the beak of the dorsal [ventral] valve a kind of shield, the walls of which rise to the cardinal border, and abut against the two sides of triangular slit. This shield is terminated in front by a median point in the form of a beak, such as one ordinarily sees in many of the Cranias. The bottom of the valve is cut in straps, irregular and separated by a very prominent interior border from the edge, which is narrow and striated."

" VAR. RETROFLEXA," de Verneuil, Pl. II., figs. 1*a–c*.

Gonambonites retroflexa, Pander, Beitr. zur geogn. Russl., p. 77, pl. 25, figs. 1 & 2.

" This variety figured by Mr. Pander under the name of *Gonambonites retroflexa* is recognized by the extreme height of the dorsal [ventral] area, by the minuteness on the contrary of the ventral [dorsal] area, reduced to the degree that it is not more than the fifth of the first, by its cardinal angle more pointed, and finally by the length of the shell. The greatest width is not at the cardinal border, but beyond the middle of the shell, and the dorsal [ventral ?] valve is much more tumid than the ventral [dorsal ?]. All these differences are softened by insensible transitions. The same modification of the ventral area, which is so striking in this variety, is not there constant, and exists sometimes, on the contrary, in the type species. Without particular attention this variety might be taken for a distinct species."

The variety found at Cape Breton would agree with *retroflexa* rather than the type, but for the remark as to the relative tumidity of the valves; this excludes it unless there has been a transposition of the terms dorsal and ventral in this part of the description.

Certain features of the dorsal valve not described by de Verneuil are the following:

A mould of the dorsal valve shows that there was a median groove running from the umbo, nearly two-thirds of the length of the shell; and on each side of the groove appear three radiating vascular ridges (furrows of the interior surface ?). At the hinge line are the moulds of two short lateral plates, and at the centre of this line a group of three pits due to the cruræ and the cardinal process; this, the central pit, which is due to the cardinal process, is larger than the others.

Size.—Length of the ventral valve 16 mm. Width 20 mm.

Locality.—Gray sandstones of McFee's Point, near George River, Cape Breton, in company with *Lingulella Selwyni*, collected by Messrs. Weston and Robert.

HYOLITHES, Eichwald.

HYOLITHES *cf.* TENUISTRIATUS, Linrs., Pl. II., figs. 2*a* and *b*.

A large species of this genus occurs in company with *Lingulella Selwyni* in the gray sandstones of McFee's Point, which is nearly related to the above Swedish species. It also resembles the Bohemian *H. maximus*, Barr., and the American *H. princeps*, Bill., but appears to be a later species than any of these.

Apical angle about 12°. No grooves were observed within the margins on the dorsal side and no furrow at the median line on the ventral side. This side somewhat flattened on the sides but much more

convex than the dorsal; on the average it is three times more convex, but the relative convexity is variable. The edge of the orifice of the shell on this side is slightly bowed upward in the middle, and near each end is a sinus where the growth line curves upwards before crossing over to the dorsal side, hence the rising arch of the edge on the dorsal side belongs partly to the ventral side.

The angles between the dorsal and ventral sides are sharp, especially in the apical half of the shell. The lip on the dorsal side is strongly arched upward, and the surface striæ correspondingly curved.

Sculpture.—On both sides are distinct transverse striæ, but no longitudinal striæ. The inner surface of the shell is smooth and does not show growth lines.

Size of the tube. Width at the aperture 14 mm. Shorter diameter at aperture 8 mm. Length of tube supposed to be about 50 mm. or more. The lip projects above the tube about 5 mm.

Locality.—Found with the preceding.

HOLASAPHUS, n. gen.

Among the fossils from McFee's Brook was a trilobite related to Asaphus, but different from any described genus. From Bathyurus, Bill., it is excluded by the shallowness of the furrows on the head-shield, and the low relief of the glabella; it is shut out of Bathyurellus, Bill., by the narrow marginal fold and long axis of the pygidium; from Protypus, Walc., by its shorter glabella, inclined to conical, and the prolonged angles of the free cheeks; from Asaphiscus, Meek, by its Megalaspis-like pygidium; from Asaphelina, Mun-Cham. and J. Berg., by having only one spine to the pygidium; from Platypeltis, Call., by its shorter, cylindro-conical glabella, and markedly segmented and lobed pygidium.

HOLASAPHUS CENTROPYGE, n. sp., Pl. II., figs. 4*a* and *b*.

Middle piece of the head sub-quadrate. Anterior margin with a distinct fold. Glabella sub-cylindrical, rounded in front, about one-quarter longer than wide, not furrowed. Occipital ring narrow, divided from the glabella by a narrow fold, and having an obscure tubercle at the back on the median line. Fixed cheeks slightly wider at the middle than half of the width of the glabella, widening before and behind the eyelobe, meeting in front of the glabella, furnished with short, prominent eyelobes, no ocular fillet. Posterior furrow and fold narrow, the former shallow.

Pygidium large sub-triangular, bordered all around, furnished behind with a sharp spine about one-third of its length. The axis is prominent and has three distinct rings and three obscure ones at the back of these; each of the front rings is furnished with a small tubercle at the back edge. The side lobes of the pygidium have four costæ and sometimes a

fifth rib is obscurely shown; the furrows of the side lobes are straight and those toward the back are directed more and more backward.

Sculpture.—This consists of a fine granulation invisible to the naked eye.

Size.—Middle piece of the head—Length 10 mm. Width at the front 11 mm., at the back 15 mm. Pygidium length exclusive of the spine 9 mm., length of spine 3 mm., width 14 mm.

Locality.—McFee's Point near George River, Cape Breton.

The material on which the above description is based contains only the parts figured, and a large free cheek, which appears to belong to another species; it is similar to the cheek of an Angelina (Pl. II., fig. *b*.) The rock in which this fossil occurs is distorted by pressure and the figures are an average of several examples collected for the distortion.

Dr. Jules Bergeron has decribed a Megalaspis from the Lower Arenig beds of the south of France, whose pygidium is similar to that of our species, but of which the head is unknown; his pygidium, however, is more exactly that of a Megalaspis.[1]

Mr. Walcott has described a pygidium from the Pogonip group of Eureka, Col., *Bathyurus congeneris*, with a broken spine which is like ours, but it lacks the border-fold.[2]

Bathyurus caudatus, Bill., from the G-A beds of the Quebec group in Northern Newfoundland, based on a pygidium only, resembles our species in the number of segments in the pygidium and in possessing a terminal spine, but it has no furrow within the border.[3]

In the fragments of rock which contain the above species are a broken head-shield of a trilobite resembling a Homalonotus and the massive genal spine above referred to. This may have belonged to a species like *Bathyurellus formosus*, Bill.

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[1] Massif Ancien au sud du Plateau Central. p. 340, Pl. iv., figs. 3 and 4.
[2] Palæontolgy of Eureka District. Pl. viii., figs. 8 and 8*a*.
[3] Palæozoic Fossils. p. 261, fig. 245.

EXPLANATION OF PLATES.

PLATE I.

Fig. 1.—*Lingulella Selwyni*, n. sp. Mag. ⅞. *a*. Ventral valve, interior showing lateral muscle-scars, scars of anterior adductors, vascular trunks, etc. *b*. Dorsal valve, showing cardinal and lateral muscle-scars, central group of four scars, vascular trunks, etc. Both from McFee's Point. **See page 255.**

Fig 2.—*Lingulella Roberti*, n. sp. Mag. ⅞. *a*. Ventral valve, showing deltidial area, vascular ridges, anterior adductor muscle-scars, vascular trunks, etc. *b*. Dorsal valve, showing cardinal muscle scar, vascular ridges, median septum, central group of muscle-scars. Both from McFee's Point. **See page 256.**

Fig. 3.—*Lingula Howleyi*, n. sp. Nat. Size. *a*. Ventral valve, abraded example, showing the diverging ridges and print of the rhomb at different stages of growth. *b*, Dorsal valve, abraded example, showing pits of lateral muscles, etc. The large lozenge at the back of this figure shows the area over which the adductor muscles have moved during the growth of the shell, and the lanceolate area in front of the lozenge outlines, the front of the visceral cavity. From Kelly's Island, Conception Bay, Newfoundland. **See page 259.**

Fig. 4.—*Lingulobolus affinis*, Bill., sp. Mag. 1½. *a*. Ventral valve mould of. *b*. Dorsal valve, mould of. **See page 261.**

The following features are noted (notation that of Messrs. Davidson and King for the Trimerellidæ):

a. deltidium	*p*. post-median scars		*v*. central scars
g. lozenge	*q*. crown	crescent	*w*. sub-cardinal scars
l. median plate	*r*. side		*x*. umbo-lateral scars
m. median scars	*s*. end		*y*. parietal scars
n. anterior scars	*t*. transverse scars		*v.t*. vascular trunks
o. lateral scars	*u*. archlet		

c. Variety *cuneata*, n. var. Mag. ⅞. Notation as above. *d*. Side view of same, showing crescent, scars of muscles and parietal band. All from Great Bell Island, Conception Bay, Newfoundland. **See page 262.**

Fig. 5.—*Sphærobolus spissus*, Bill., sp. Mag. ⅞. *a*. Ventral valve, mould of; Notation as in preceding species. *b*. Dorsal valve, *e* cardinal callosities, notation otherwise as above. *c*. Section of the two valves to show the convexity. All from Great Bell Island. **See page 263.**

PLATE II. (PART)

Fig. 1—*Clitambonites* (*Gonambonites*) *plana*, Pander, var. Mag. ⅞. *a*. Ventral valve, mould of, showing deltidium, shield-like scar at the umbo, strap-like radiating grooves, and crenulated margin. *b*. Dorsal valve, mould of, showing low hinge area, wide deltidium, cardinal process, cruræ, crural plates, dorsal furrow, and vascular furrows. *c*. Section of the two valves, in profile. All from McFee's Point, Cape Breton. **See page 266.**

Fig. 2.—*Hyolithes* c.f. *tenuistriatus*, Linrs. Nat. size. *a*. The conical shell, distal half showing the ventral side and lip of the dorsal side. *b*. The same, side view. From McFee's Point, George River, Cape Breton. **See page 267.**

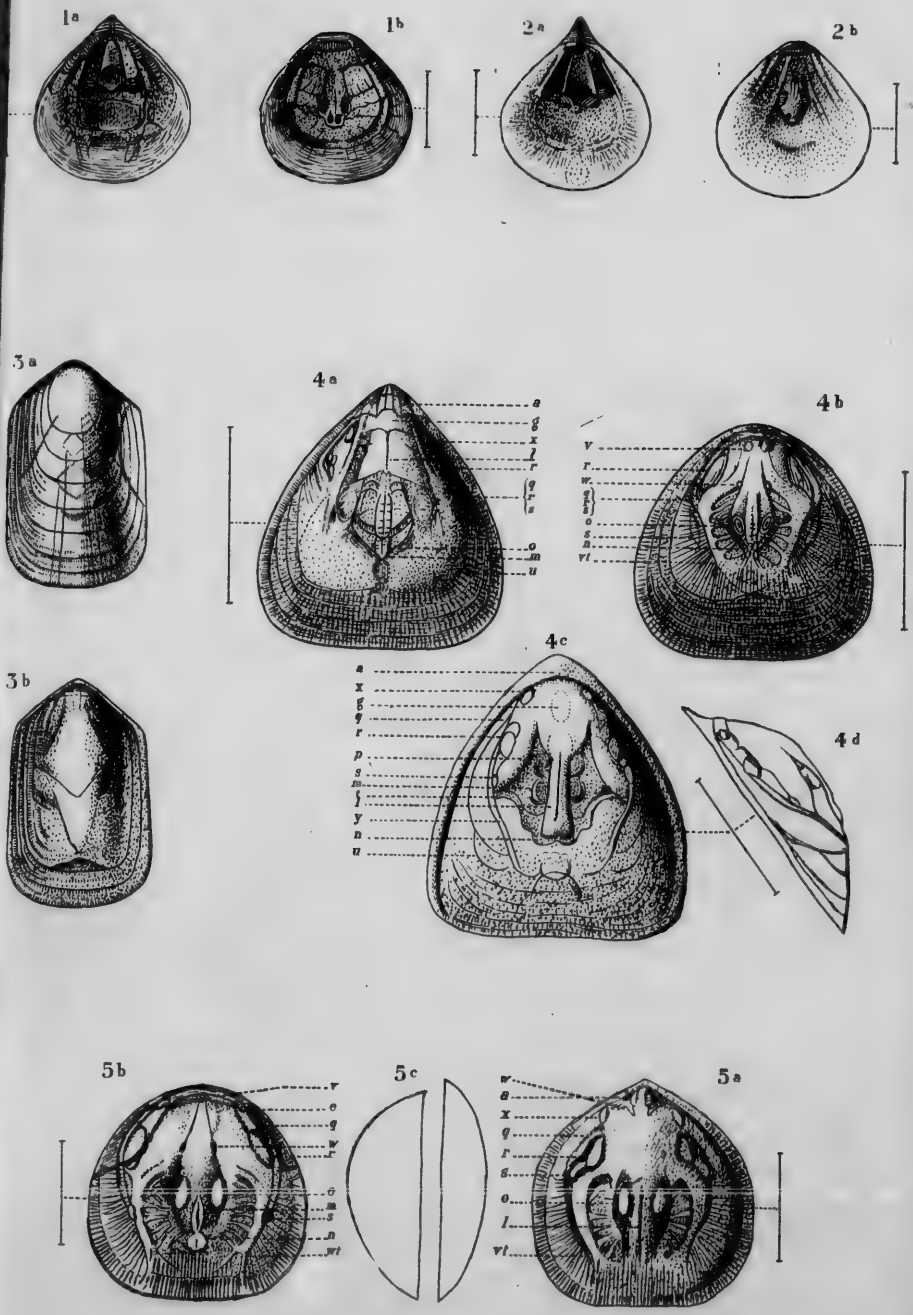
Fig. 3.—Movable cheek of a trilobite. Nat. size. Same locality. **See page 269.**

Fig. 4.—*Holasaphus centropyge*, n. gen., et sp. Mag. ½. *a*. Middle piece of the head-shield. *b*. Pygidium. N.B. The side lobes should have one furrow less. From McFee's Point, near George River, Cape Breton. **See page 268.**

Fig. 5.—*Lingulepis acuminata*, Conrad? Mag. ½. *a*. Ventral valve, showing the position of the posterior adductor, the lateral and the central muscles. *b*. Dorsal valve, showing the posterior adductor and the lateral and one pair of the central muscles, as well as the course of the vascular trunks. Sandstone, Beverly, Ont. **See page 257.**

3a

3b


1a
1b
2a
2b
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4a
4b
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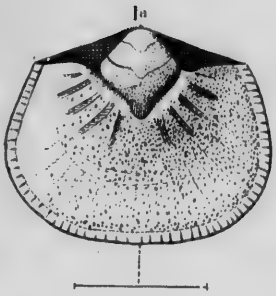
4c
4d
5b
5c
5a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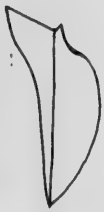
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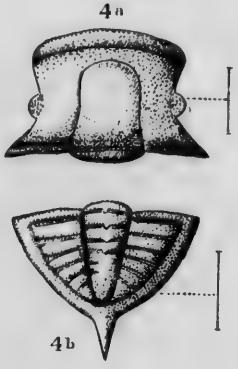
3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4b

2a
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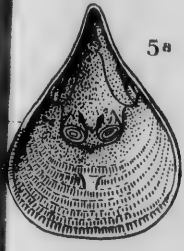
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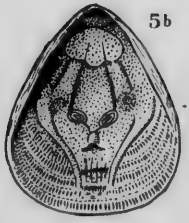
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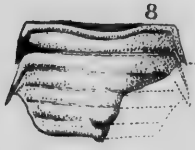
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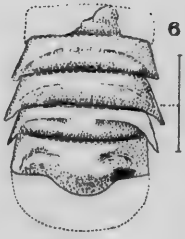
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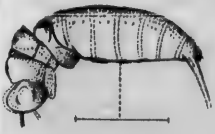
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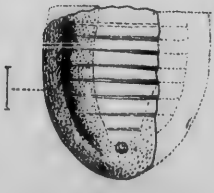
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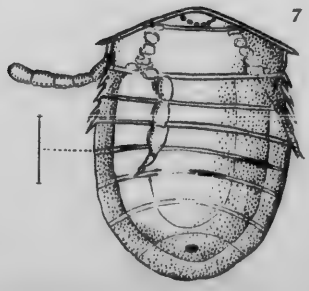
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XIV.—*Organic Remains of the Little River Group, No. IV.*

By G. F. MATTHEW, D.Sc.

(Read May 16th, 1895.)

THYSANURA.

It is somewhat remarkable that among the many fossil insects that have been described, the Thysanura have few or no representatives. Since there is a considerable number of species extant in the modern world, one might reasonably expect that the study of the extinct faunas would give to science at least a few species of this order.[1] In fact, in a type so primitive as to have the three somites of the thorax separate from each other, we would naturally look for a larger proportionate representation among the insects of the ancient world. It is clear, however, that such a larger proportion has not yet been found. These considerations add special interest to a discovery in the plant beds at St. John, of the remains of an insect that appears to belong to this order.

PODURITES, n. gen.

PODURITES SALTATOR, n. sp., Pl. II., Fig. 10.

Body cylindro-fusiform. Head oblately oval, slightly extended behind, and showing traces of antennæ and eyes.

Thorax one-fifth longer than wide, of three separate segments, which are about twice as wide as long; the anterior angles of the first segment are rounded in toward the head and the posterior angles of the third segment has lobes projecting backward on each side of the abdomen.

The abdomen is fusiform, rapidly tapering in the posterior third, composed of about seven rings, and terminated by a spring (elater), the root of which appears to have been attached to the penultimate segment, and was fluted on the sides.

Size.—Length of the body, exclusive of the appendages, 20 mm.; width 3 mm. Length of the head 2 mm., of the thorax 4 mm., and of the abdomen 8 mm.

Horizon and *Locality.*—Plant Bed No. 2, Lower Cordaite Shales, Little River Group, St. John, N.B. Rare.

[1] A very peculiar acephalous insect found at Florissant has been referred to this order by Dr. Scudder, and an imperfect Lepisma was found at the same locality.

This little creature is clearly a hexapod and can best be referred to the Thysanura, as the three segments of the thorax are separate; there is a spring (elater) to the abdomen, and there are no traces of wings. It has not the compactness of body of the modern Springtail, but in its elongated form it approaches the species of Lepisma or Bristletails; however, these have more numerous segments to the abdomen than Podurites; and the strong stylet or spring of the latter is a distinguishing feature, that precludes us from placing it in Lepisma: the form and segmentation of the abdomen is thus intermediate between Podura and Lepisma, but sufficiently distinct from either to warrant the establishment of a new family for which I would suggest the name Poduritidæ.[1]

ARACHNIDA.

According to Dr. S. H. Scudder (1881) two hundred and fifty species of Arachnids have been described from the Tertiary deposits. Of these one hundred and ninety are true spiders, while the remainder are Acarina (mites), Ophiliones (11 species), Chernitidæ (9 species). Of these insects nine-tenths (1886) have been preserved in amber, leaving only a quarter of a hundred species from other sources as representatives of this great division of the ancient insect world when Dr. Scudder commenced his studies on the insect fauna of Florissant. This fauna is contained in lacustrine clays, and the result of Dr. Scudder's study of the insect remains contained in it—if we omit from consideration the Arachnids of the European amber—more than doubled the number of Arachnids known as fossils up to that time.

While this was the relative number of the European and American Tertiary spiders up to this time, important additions were also being made to our knowledge of the Palæozoic Arachnids, for in the succeeding decade spider-like animals began to be found in the coal measures and among them several peculiar types, differing from any known in the later ages. Among these were the Anthracomarti of Kærsch, differing widely from modern spiders, and established as a separate order by that author.

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[1] Since the above paper was written another Thysanuran has been found, more remarkable than Podurites—that is, more difficult of comparison with any other modern form. While exhibiting the separate segments which are found in the thoraces of the Thysanurans, its head can only be compared with that of Scudder's genus Planocephalus, from the Oligocene beds of Florissant, or with certain suctorial Hemiptera. Perhaps it might be said that the existence of such a form as Planocephalus, best explains the peculiar structure of the new type, for it can be referred to the Thysanurans only on the same general considerations as have governed Dr. Scudder in so referring that genus.

The following summary of the fossil Arachnida is condensed from Dr. Scudder's review of these forms given in Bulletin 31 of the United States Geological Survey.[1]

Acari (Mites), Tertiary	36	species.
Chelonethi (Pseudoscorpions), Tertiary	9	"
Anthracomarti (extinct order), Carboniferous	16	"
Pedipalpi (Spider Scorpions), Carboniferous	2	"
Scorpiones (Scorpions), 3 Silurian, 8 Carboniferous, 1 Tertiary	12	"
Ophiliones (Spider Mites), Tertiary	13	"
Araneæ (Spiders)—2 Carbonif., 1 Jurass., 226 Tertiary	229	"

It is chiefly with the extinct order of Anthracomarti that we are at present interested, and this from the fact that Arachnids allied to this order have been found in the plant beds at St. John.

EURYMARTUS, n. gen.

EURYMARTUS LATUS, n. sp., Pl. II., Fig. 7.

Body oval, angulated in front at the sides. No distinction of width between the cephalothorax and the abdomen.

Cephalothorax bounded by a narrow raised border or rim. The cephalon has traces of organs in front which are probably antennæ; and centrally has a curved row of six (or eight) small scars, in a position where the eyes might be looked for. The cephalon is divided from the thorax by a narrow, low border.

The thoracic segment is sub-quadrilateral, more than three times as long as wide, sides slightly contracted at the back where it joins the first abdominal segment. The thorax is inclosed by a narrow raised rim, and has protective spines at the anterior and posterior corners on each side, the anterior spines directed outward and the posterior backward. On each side of the thorax is a row of about eight scars; these rows are inclined towards each other anteriorly, but are as far apart in front as the cephalothorax is long. At the front edge of the thorax in a line with the row of scars on each side, is a small elongated scar which may mark the point of attachment of a palpus; also at the back of the thorax, outside the posterior scars on each side of the thorax, is a small round scar, perhaps indicating a spiracle.

The abdomen of seven joints, is about as long as wide. It is divided longitudinally in three regions, a central one or rachis, inclosed by a sloping pleural region, and the whole bordered by a slightly raised, rather broad, marginal band. The first two rings of the abdomen are armed on each side with anterior and posterior spines, directed backward, the five posterior segments are arched more and more at the sides as they

[1] Systematic review of our present knowledge of fossil insects, U.S. Geol. Survey, Bulletin No. 31.

approach the posterior extremity; the last joint is broadly lenticular, obscurely outlined and contains the anus.

The suture at the back of the thorax and the sutures between the three first joints of the abdomen are of equal prominence, but those of the posterior segments of the abdomen become more and more obscure.

The imprints of two detached limbs of the thorax have apparently been preserved; the limbs as thus shown consist of six joints, which are about as long as the segments of the abdomen, except the fourth joint which is longer; the posterior joint is narrow and sharp-pointed. A detached anterior limb, which has been preserved, has a broad, probably lamellar termination.

Sculpture.—The whole body was granulated, the markings being just visible to the naked eye.

Size.—Length 10 mm. Width 7½ mm. Length of the limbs 5 mm.

Horizon and *Locality.*—Same as the preceding species. Rare.

This remarkable Arachnid is different from any known type, but it appears to come nearer the genus Anthracomartus than to any other forms of this sub-class, ancient or modern.

EURYMARTUS (?) SPINULOSUS, n. sp., Pl. II., Fig. 9.

A rather smaller species than the preceding. Only the abdomen is known.

The abdomen is ovate behind, and is marked by nine transverse rings. The three posterior and the anterior ring are obscurely defined (the latter owing to imperfect preservation). There is a marginal ridge near the sides and back of the abdomen; along the inner margin of this ridge at the sides there is a double row of spines (the row on the marginal ridge being directed inward and backward, and that at the ends of the segments being turned outward and backward). A pustule within the marginal ridge, at the posterior end of the abdomen, appears to mark the position of the anus.

Sculpture.—The surface is very finely pitted.

Size of the abdomen.—Length and width each 6 mm.

Horizon and *Locality.*—Same as the preceding. Rare.

This little species, by its broad marginal rim, straight anterior edge to the abdomen, and form of the segments, appears to belong to Eurymartus, but the absence of the cephalothorax makes the reference doubtful.

Though we have said that these Arachnids are allied to the Anthracomarti, it is only by a distant relationship. The most obvious distinction is the entirely different arrangement of the bases of the limbs, and the absence of wedge-shaped segments to the cephalothorax. The coxæ are arranged in two distant rows converging forward. It would appear then

that this type belongs to another order for which the name Eurymarti is proposed. The following are its distinctive features:

Order EURYMARTI.

Body depressed. Cephalothorax and abdomen of equal width, not clearly divided. Coxæ crowded in two rows distant from each other, converging forward. Abdomen forming a single mass of seven to nine segments sub-equal in width.

Family EURYMARTIDÆ.

Distinguished from Architarboidæ as follows:

Cephalothorax less than half of the length of the abdomen. Coxæ spreading from a broad trapezoidal space on the thorax. Abdomen oval, segments sub-equal in width.

From the genus Anthracomartus, its nearest ally, Eurymartus, is distinguished by its smaller but broad cephalothorax, obtusely triangular in front. Also by its oval abdomen nearly uniform in outline with the cephalothorax.

EURYMARTUS, sp. ? Pl. II., Fig. 8.

This very defective fossil is referred to the Arachnida on account of its resemblance to the abdomen of Eurymartus.

It consists of seven or more cemented segments. Of these the two anterior are separated by a stronger line of demarkation from the others, than the lines of division between these latter. The first segment is narrow (longitudinally) and is terminated at each end by a spine projecting backward; it has on the front edges a facet about half its length, apparently for the articulation of the cephalothorax. The remaining rings of the abdomen are apparently of about equal width. The second, third and fourth rings have lateral spines directed backward; those on the third ring are heavier than those on the rings in front. The rings behind the fourth do not show spines, but this may be due to the imperfect preservation of the fossil, as the posterior part of the abdomen is broken away. The sixth ring has a tubercle on the median line.

Sculpture.—The surface has a fine granulation, just visible to the naked eye.

Size.—Length of the part preserved 4 mm. Width 7 mm.

Horizon and *Locality.*—Dark shale of Plant Bed No. 8, Lower Cordaite Shales, Little River Group, St. John, N.B. Rare.

This peculiar fossil has some resemblance to the pleon of an Isopod, but differs in the following respects: The number of segments is in excess of those in that part of an Isopod, and they are narrower than such segments; they are also anchylosed, for the divisional lines are obscure.

From the known species of Eurymartus this fossil differs in the short facet at the front of the abdomen indicating a cephalothorax narrower than the abdomen, and in the absence of a marginal rim.

CRUSTACEA.

AMPHIPELTIS PARADOXUS, Salter, Pl. II., Fig. 6.

Quart. Jour. Geol. Soc., Feb., 1863.
Acad. Geol., 2nd Ed., p. 523.

The type of this crustacean, described some thirty years ago by Mr. J. W. Salter, is not now available to me ; I therefore describe herein the example preserved in the museum of the Natural History Society of New Brunswick, St. John, N.B.

This consists of five segments of the body. Of the anterior segment only a fragment is preserved ; the next three segments bear pleural spines directed backward, those on the two posterior of the three being larger ; in the last segment the spinal ridge is turned inward and apparently fused with the segment, forming part of a broad, lamellar terminal, plate, as in the typical example described by Mr. Salter.

Sculpture.—The several segments bear various markings ; the second has two small tubercles near the axial line, and the fourth and fifth have pleural grooves, somewhat distinctly impressed. The whole surface of the test is minutely pitted.

Size of this mutilated example. Length 15 mm. Width 12 mm.

Horizon and *Locality.*—From Plant Bed No. 2, Lower Cordaite Shales Little River Group, St. John, N.B.

Judging by the name given it, this was a perplexing fossil to Mr. Salter. Sir J. W. Dawson suggested that it might have been allied to the Stomapods,[1] a not unreasonable suggestion, considering the width of the front part, as shown by the type which Mr. Salter described. However, with the author's present view that all the animals of this plant bed, are either aerial, terrestrial or palustral forms, he is compelled to look elsewhere for relatives of this crustacean. Among terrestrial Crustaceæ the Isopods seem the group which would most likely have left remains such as this. If Amphipeltis be of this group, the rapidly varying segments would indicate that the example in the museum of the Natural History Society is a part of the pleon, probably the principal part ; and would indicate, so far as modern Isopods are concerned, an animal of very considerable size ; but still one not by any means so large as some fossil Isopods reported from the coal measures, and referred to the family

[1] Acadian Geology, 2nd Ed., p. 523.

Arthropleuridæ of Zittel.[1] These, however, were tuberculated forms, while Amphipeltis has a smooth test.

Among the marine Isopods *Cerolana concharum*, Harger, has a pleon similar to this fossil.[2]

EXPLANATION OF PLATE II. (PART).

Fig 6.—*Amphipeltis paradoxus*, Salt. Mag. ½. Posterior part of the body, showing five segments, Plant Bed No. 2, Lower Cordaite Shales, Lancaster, N.B. **See page 278.**

Fig. 7.—*Eurymartus latus*, n. sp. Mag. ½. Under side of the body with some of the limbs preserved. Same locality and horizon. **See page 275.**

Fig. 8.—*Eurymartus*, sp. ? Mag. ½. Seven segments of the body. Plant Bed No. 8, Lower Cordaite Shale, Lancaster, N.B. **See page 277.**

Fig. 9.—*Eurymartus (?) spinulosus*. Mag. ½. Nine segments of the abdomen. Plant Bed No. 2, Lower Cordaite Shale, Lancaster, N.B. **See page 276.**

Fig. 10.—*Podurites saltator*, n. sp. Mag. ½. Head, thorax and abdomen. Same horizon and locality. **See page 273.**

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[1] Treatise on Palæontology, vol. ii., p. 662.

[2] U. S. Commission, Fish and Fisheries, Report, 1878 (1880). Pl. ix., fig. 55, and pl. x., fig. 59.